

DOCUMENT RESUME

ED 228 290

TM 830 199

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TITLE Academic Anxiety, Time-on-Task and Achievement: A Structural Model.
PUB DATE Apr 83
NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (67th, Montreal, Quebec, April 11-15, 1983). Research supported in part by the Veterans Administration, Hospital Rehabilitation Research and Development Lab., Hines Hospital.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; *Anxiety; Attention Span; Black Students; *Grade 7; Low Achievement; *Mathematical Models; *Reading Achievement; Reading Tests; Secondary Education; Student Reaction; *Time on Task; Urban Education
IDENTIFIERS End of Cycle Reading Test; Iowa Tests of Basic Skills

ABSTRACT

Considerable research has been conducted on the effect of anxiety on academic achievement. The most consistent finding is that high anxiety is associated with low performance, particularly at the elementary school level. To explain this situation, some researchers have hypothesized that anxiety debilitates students' attention span or time-on-task thus negatively affecting their achievement. This study tested that hypothesis. The sample consisted of 91 inner city black students between the ages of 12 and 14. The achievement area was seventh grade reading. Two instruments measured each of the three constructs (academic anxiety, time-on-task and reading achievement). A structural equation model tested the association among the variables. The results confirmed the hypothesized negative association between anxiety and achievement and the positive relation between time-on-task and achievement. When the time-on-task parameter was included in the model the association of anxiety with achievement dropped significantly. This finding is taken as evidence for the importance of time-on-task as a mediating variable between academic anxiety and reading achievement.
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Academic Anxiety, Time-on-Task and Achievement:
A Structural Model

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This research was supported in part by the United States
Veterans Administration, Rehabilitation Research and Development
Laboratory, Hines Hospital, Hines, Illinois.

Paper presented at the American Educational Research Association
Meeting. Montreal, Canada. April 1983.
Paper printed in U.S.A.

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Academic anxiety, time-on-task and achievement:
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Abstract

Considerable research has been conducted on the effect of anxiety on academic achievement. The most consistent finding is that high anxiety is associated with low performance, particularly at the elementary school level. To explain this situation, some researchers have hypothesized that anxiety debilitates students' attention span or time-on-task thus negatively affecting their achievement. This study tested that hypothesis. The sample consisted of 91 inner city black students between the ages of 12 and 14. The achievement area was seventh grade reading. Two instruments measured each of the three constructs (academic anxiety, time-on-task and reading achievement). A structural equation model tested the association among the variables. The results confirmed the hypothesized negative association between anxiety and achievement and the positive relation between time-on-task and achievement. When the time-on-task parameter was included in the model the association of anxiety with achievement dropped significantly. This finding is taken as evidence for the importance of time-on-task as a mediating variable between academic anxiety and reading achievement.

Considerable research has been conducted on the effect of anxiety on academic achievement. The most consistent finding, summarized by Gaudry & Speilberger (1971), is that high anxiety is associated with low performance, particularly at the elementary school level. Their conclusion is based on the negative correlations obtained in a number of studies between different measures of anxiety and a variety of measures of academic aptitude and achievement.

The debilitating effects of anxiety on academic performance have been explained by Sarason, et al. (1960): The high anxious child is more aware of his or her own covert responses to anxiety symptoms than he is of the nature of the external stimulus situation, which includes the stimulus task and accompanying instructions. Also, Wine (1971, 1980) in her Direction of Attention Hypothesis states that the high anxious student divides his/her attention between self-preoccupied worry and task cues, while the less anxious student focuses more fully on task-relevant variables. Marlett & Watson (1968) concluded that the high anxious student spends a part of his task time doing things which are not task oriented. "He worries about his performance, worries about how well others might do, ruminates over choices open to him, and is often repetitive in his attempts to solve the task."

If time-on-task is related to anxiety level as Sarason, et al., Wine, and Marlett & Watson have theorized, then time-on-task may function as a mediating variable in the anxiety/achievement relation. That is, if time-on-task is increased, then anxiety should decrease and achievement, as a consequence, should improve. Partial support

for this position is provided by Anderson (1973) and Hecht (1978) who found a positive relation between time-on-task and academic achievement. Prior to the research reported in this paper, however, no effort had been extended to investigate these causal relationships between anxiety, time-on-task, and achievement.

Sample

The study was conducted in four seventh grade Chicago inner-city classrooms in two elementary all black schools (two classrooms per school). The four classrooms essentially consisted of the entire seventh grade population of both schools. The schools were selected at random from the twenty five schools in the immediate area. The sample initially consisted of 107 children between the ages of 12 and 14. Ninety one (85%) of the children completed all instrumentation. The subject area was seventh grade reading. The anxiety and time-on-task data were collected in March, 1981. The achievement instruments were administered in May, 1981.

The Variables of the Study

Academic anxiety can be described as an unpleasant, emotional reaction to an evaluative situation in a classroom. It is characterized by subjective feelings of tension, apprehension, uncertainty and by activation or arousal of the autonomic nervous system (from Spiel-

berger, 1972). It was assessed in two ways. The Test Anxiety Scale for Children developed by Sarason et al. (1960) was used to measure self-report of anxiety (TASC). It is a group administered paper and pencil test consisting of 30 items to which the student responds "yes" or "no" by circling the appropriate response. Factor analytic studies of the TASC were reported by Dunn (1964). Four significant factors emerged from the analyses. They were labelled test anxiety, school anxiety, recitation anxiety and physiological arousal in anticipated recitation situations. Dunn concluded that the TASC not only measured test anxiety but also a broader school anxiety when all of its items were considered.

Wine (1980) has advocated changing the name (test anxiety) to some other term more descriptive of individuals who typically interpret a wide range of situations as evaluative and react with cognitive concern and performance deficits in academic contexts. Since this study is concerned with anxiety among elementary school children the phrase academic anxiety has been coined to encompass the children's anxiety reactions in a number of classroom situations, e.g. seatwork, answering teacher's direct questions, recitation, test-taking, etc.

A naturalistic observation coding scheme to measure the overt behavioral components of academic anxiety (OANXP) was developed by the first investigator as a second measure of academic anxiety. It utilized the anxiety behavioral symptoms suggested by Phillips (1978) and Kurzweil (1968). Each child was observed in three classroom behavioral contexts: interactions with teacher, test-taking behavior and

seatwork behavior. The unit of measurement was time (seconds). Each child was observed for 30 seconds, six times per experimental segment. Scoring was the number of seconds of observed anxiety behavior divided by the total number of seconds observed. This OANXP scale is concerned with the measure of many anxiety states over time so that the total instrument becomes a measure of trait academic anxiety.

Time-on-task refers to the time during which the student is actively (overtly or covertly) involved in learning. It was measured in two ways. A modified naturalistic observation procedure (OTOT), originally developed by Anderson (1973) was utilized to measure overt participation of the learner during instruction. Each child was observed in three separate classroom contexts: interactions with teacher, test-taking activity and seatwork. At the beginning of the observation schedule, the observer watched a randomly selected individual for a period of 30 seconds. He decided whether or not and for how long the student was on task (paying attention). This procedure was continually repeated until the entire class had been appropriately coded. Between five and eight 30 second sweeps were accomplished for one observation segment. The scoring strategy was the student's amount of time-on-task divided by the total observed time.

A second component (CTOT) of time-on-task measurement was based on a modification of a simulated recall technique developed by Bloom (1953). At random points during the reading instruction, the students were asked to stop working, or listening to the teacher and write in a sentence what they were thinking just prior to being told to stop

working. They were then requested to resume their normal activity. The student reports were then given to two readers who coded the thought as on-task or off-task on a five-point Likert scale. This procedure was accomplished twice per experimental period.

Achievement is defined as a summary cognitive measure of what a student has learned (in this case reading) as a result of many units or weeks of work. Two different types of reading achievement data were gathered-standardized and localized. The IOWAR Test of Basic Skills/Reading (IOWAR) is a standardized achievement test designed to provide information on the status of elementary students' development in the basic skill areas of reading. The Primary Battery of the ITBS/Reading (Level 13-Seventh Grade) includes tests in four major reading areas: vocabulary (48 items), reading comprehension (78 items), language (166 items) and work study (128 items). The ITBS/Reading scores for this study's sample were made available for May 1981.

A second measure of achievement was administered to all sample students in May 1981. This summative or End of Cycle (EOC) reading test is a 40 item local test developed by the Chicago Board of Education as a final exam for its reading program. The exam is divided into four blocks of 10 items corresponding to the main reading objectives covered by the seventh grade reading curriculum, namely: language, work study skills, vocabulary and reading comprehension.

Design

The results reported in this paper are concerned with testing the relationship between academic anxiety, time-on-task and achievement. Specifically, time-on-task was hypothesized to mediate the effect of anxiety upon achievement. This hypothesis assumes the relation between anxiety and achievement is negative and significant. If the hypothesis is true, then the relation between anxiety and achievement may remain negative but becomes insignificant as the time-on-task variable is introduced.

In order to test the primary hypothesis a structural equation model was specified. This approach is appropriate when multiple measures of hypothetical constructs are available and a causal structure is specified. The anxiety construct (or factor) was measured by the OANXP and TASC indicator variables; time-on-task by OTOT and CTOT; achievement by IOWAR and EOC. The intent of the model is to estimate the structural parameters among the three factors. Each parameter represents the direction and strength of relation between a pair of factors. The model is represented in Figure 1.

 Insert Figure 1 about here

The data are presented in Table 1. LISREL IV (Joreskog & Sorbom, 1978) was used to analyze the correlation matrix rather than a covari-

ance matrix. This is the more appropriate choice as the scales for the various variables are quite arbitrary in their nature. One important problem with the naturalistic observation instruments OANXP and OTOT was that the observation periods for them were identical. Identical observation periods can yield correlated measurement errors. In order to incorporate this information, a measurement error correlation between the two naturalistic observation instruments was estimated from the data.

 Insert Table 1 about here

Since the constructs used in this analysis are all subject to some degree of measurement error, an attempt was made to ascertain the degree of this error for each variable. For OANXP, TASC, OTOT and IOWAR, this measure was a simple correlation between the results for the administration of the instrument on two occasions. This information was not available for CTOT and EOC. For CTOT reliability was measured by a laboratory assessment of the coder reliability; for EOC an internal consistency measure (KR-20) was applied. These reliabilities (see Table 1) were used to construct the factors from the indicator variables. This information is often not available for instruments used in structural equation modelling. By making use of the reliabilities to estimate the factor loadings of the indicators, we gain some extra degrees of freedom for precision of estimation and evaluation of model fit.

The first analysis tested the direct effect between anxiety and achievement. The second analysis tested the mediating effect time-on-task has upon the anxiety/achievement relationship. The third analysis tested the significance of the mediating effect of time-on-task after restricting the direct effect between anxiety and achievement.

Results

As expected, academic anxiety is found to correlate negatively with standardized and localized achievement (see Table 1). These correlations between academic anxiety and reading achievement are a replication of the Gaudry & Spielberger (1971) findings. They also confirm earlier findings, (Phillips, et al., 1972), that black inner-city elementary school students are just as anxious when their achievement is low, and vice versa, as their middle class counterparts.

Another finding which Table 1 provides is the negative correlations between academic anxiety and overt and covert time-on-task. These data seem to be a confirmation of the Wine (1971) and Sarason, et al. (1960) theories that highly anxious children perform poorly on cognitive tasks because of an attentional impairment. What the anxious student is actually attending to during periods of anxiety is open to speculation. He may be preoccupied with his internal sensations (why is my heart beating so fast, or why are my palms so sweaty?). He may be concerned with other classmates' attitudes

toward his abilities. He may be frightened of alienating an authority figure (teacher), or the anxious student may be chastizing himself for blocking on material he consciously knows he has already assimilated. Some or perhaps all of these thoughts may become conscious during anxious periods and interfere with and diminish the attentional efforts and time needed to answer a teacher's question or exam item.

Also, as expected, time-on-task (both overt and covert) was found to be strongly positively related to summative achievement. This finding is a replication of many earlier studies including Anderson (1973), Hecht (1977) and Duby (1980).

The correlational structure found in Table 1 supplied the empirical data for the causal model specified in Figure 1. The direct path B3 connects anxiety and achievement, and the indirect paths (B1 and B2) involve the time-on-task construct as an intervening variable. If B3 is zero, all influence of anxiety on achievement would be mediated by time-on-task. If B3 is large, two interpretations would be possible: (a) constructs that were not included in the model, such as achievement motivation, are important mediating variables; (b) academic anxiety has a strong direct effect on reading achievement.

Incorporating the above descriptive data into the structural model yields several important statistics. The estimates for the three models are represented in Figure 2. In the initial model the t-ratio ($B3/s.e.(B3)$) gives an assessment of the statistical significance of the estimate of B3. The t-ratio of -2.37, $p < .05$ for B3

(-1.36/.575) indicates a significant negative relation between anxiety and achievement, replicating the many findings of the studies reported in Guadry and Spielberger (1971). The chi-square goodness of fit statistic for the initial model indicates that the fit of the model to the data is adequate. In the full model, the estimates of B1 and B2 are statistically significant at the .05 level with t-ratios of -2.53 and 2.10, respectively. Now, however, the t-ratio for B3 falls short of significance (-.89). This finding suggests that the time-on-task variable (XB) is responsible for the parameter estimate decline of B3 from -1.36 to -.514. In addition, the measurement error correlation was found to be quite high (-.39) which, with a standard error of .095, constitutes a significant correlation. Restricting B3 to zero has little effect on the estimates of B1 and B2 except to increase their significance. The chi-square goodness of fit statistics indicate that the models' (full and restricted) fit to the data is quite adequate. The incremental lack of fit for the restricted model is minimal (to 7.05 from 6.33), reflecting the small t-ratio for B3.

Insert Figure 2 about here

Conclusion

In summary, because the estimate of B3 (the association of anxiety with achievement) dropped significantly when the time-on-task parameter was included in the model, this finding may be taken as evidence for the importance of time-on-task as a mediating variable between academic anxiety and reading achievement as theorized by Wine (1980) and others. In addition, academic anxiety was found to inhibit time-on-task or attention span, and because time-on-task is related to achievement, this repression of time-on-task has negative repercussions on reading achievement. This causal model analysis has demonstrated one mechanism by which anxiety reduces students' reading achievement by forcing the student's attention away from the cognitive task and onto less pertinent and efficient modes of thought.

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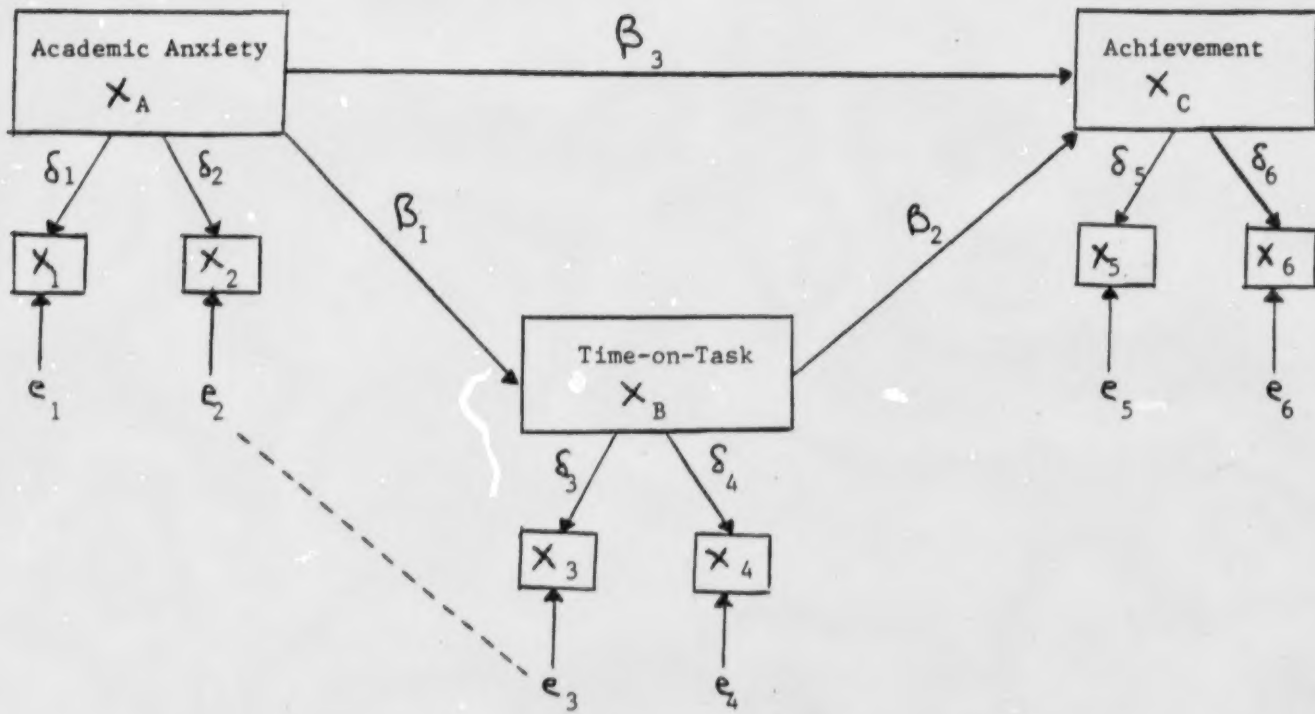
Abstract

Considerable research has been conducted on the effect of anxiety on academic achievement. The most consistent finding is that high anxiety is associated with low performance, particularly at the elementary school level. To explain this situation, some researchers have hypothesized that anxiety debilitates students' attention span or time-on-task thus negatively affecting their achievement. This study tested that hypothesis. The sample consisted of 91 inner city black students between the ages of 12 and 14. The achievement area was seventh grade reading. Two instruments measured each of the three constructs (academic anxiety, time-on-task and reading achievement). A structural equation model tested the association among the variables. The results confirmed the hypothesized negative association between anxiety and achievement and the positive relation between time-on-task and achievement. When the time-on-task parameter was included in the model the association of anxiety with achievement dropped significantly. This finding is taken as evidence for the importance of time-on-task as a mediating variable between academic anxiety and reading achievement.

Paper presented at the American Educational Research
Association Annual Meeting. Montreal, Canada. April 15, 1983.
Paper printed in U.S.A.

Figure 1

Complete Causal Model of the Association among
the Outcome Variables



Indicators

- X₁ - Test Anxiety Scale for Children
- X₂ - Overt Anxiety Naturalistic Observation Scale
- X₃ - Overt Time-on-Task
- X₄ - Covert Time-on-Task
- X₅ - Iowa Test of Basic Skills - Reading
- X₆ - End of Cycle Reading Test

LABEL

- TASC
- OANXP
- OTOT
- CTOT
- IOWAR
- EOC

TABLE 1

DESCRIPTIVE STATISTICS DATA MATRIX OF INDICATORS AND
PARAMETER ESTIMATES OF THE CAUSAL MODEL $n = 91$

	TASC	OANXP	OTOT	CTOT	IOWAR	EOC
TASC	1.00					
OANXP	.24	1.00				
OTOT	-.17	-.66	1.00			
CTOT	-.11	-.25	.36	1.00		
IOWAR	-.32	-.43	.53	.39	1.00	
EOC	-.18	-.33	.45	.28	.55	1.00
Means	17.49	43.84	66.06	2.85	5.51	26.68
Standard Deviations	5.49	18.34	20.55	1.01	1.39	5.77
Reliability	.72	.74	.73	.77	.84	.82

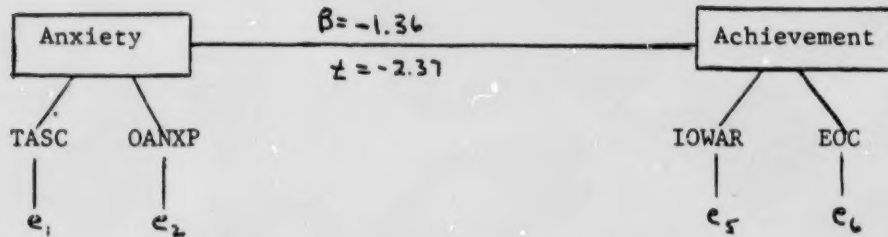
Parameter Estimates between		Point Estimate	Standard Error	t-ratio
Initial Model				
Anxiety and Achievement	β_3	-1.36	.575	-2.37*
Model Fit		$\chi^2_3 = 3.14 \quad p = .37$		
Full Model				
Anxiety and Time-on-Task	β_1	- .869	.344	-2.53*
Time-on-Task & Achievement	β_2	.873	.415	2.10*
Anxiety and Achievement	β_3	- .514	.585	-.89
Model Fit		$\chi^2_8 = 6.33 \quad p = .61$		
Restricted Model ($\beta_3 = 0$)				
Anxiety and Time-on-Task	β_1	- .916	.320	-2.86*
Time-on-Task & Achievement	β_2	1.259	.287	4.39*
Model Fit		$\chi^2_9 = 7.05 \quad p = .63$		

* $p < .05$.

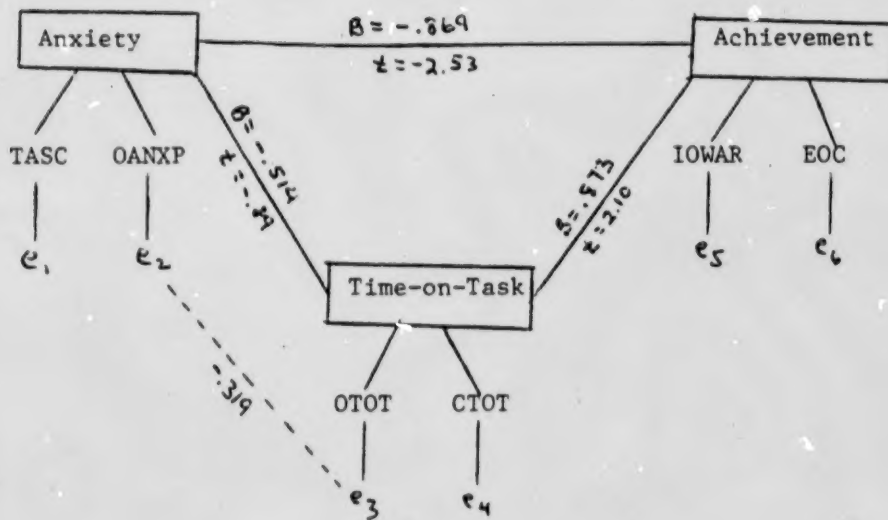
Figure 2

Estimation Results for the Three Causal Models

Initial Model



Full Model



Restricted Model

